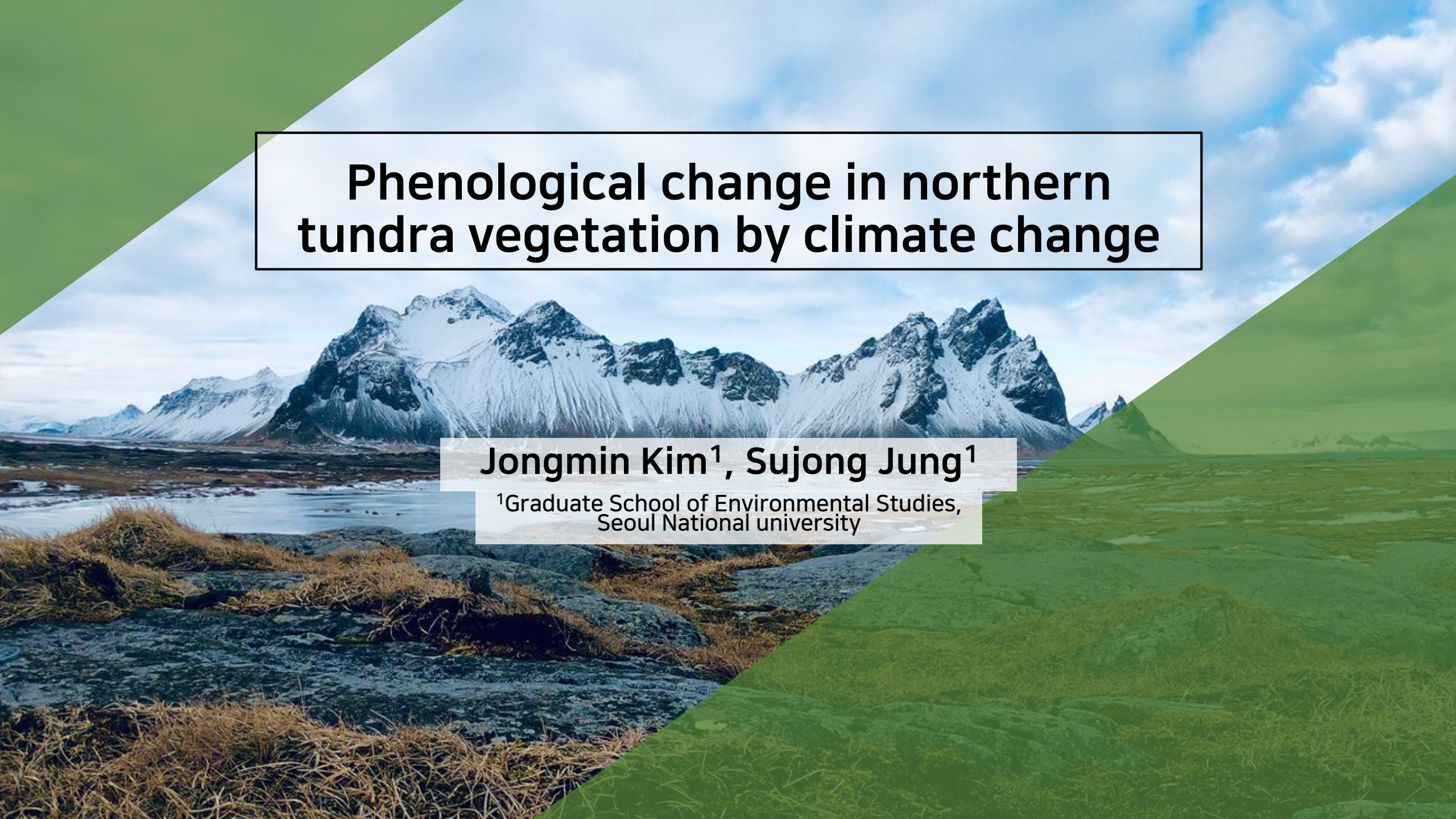
Phenological change in northern tundra vegetation by climate change



Jongmin Kim[1], Sujong Jung[1]

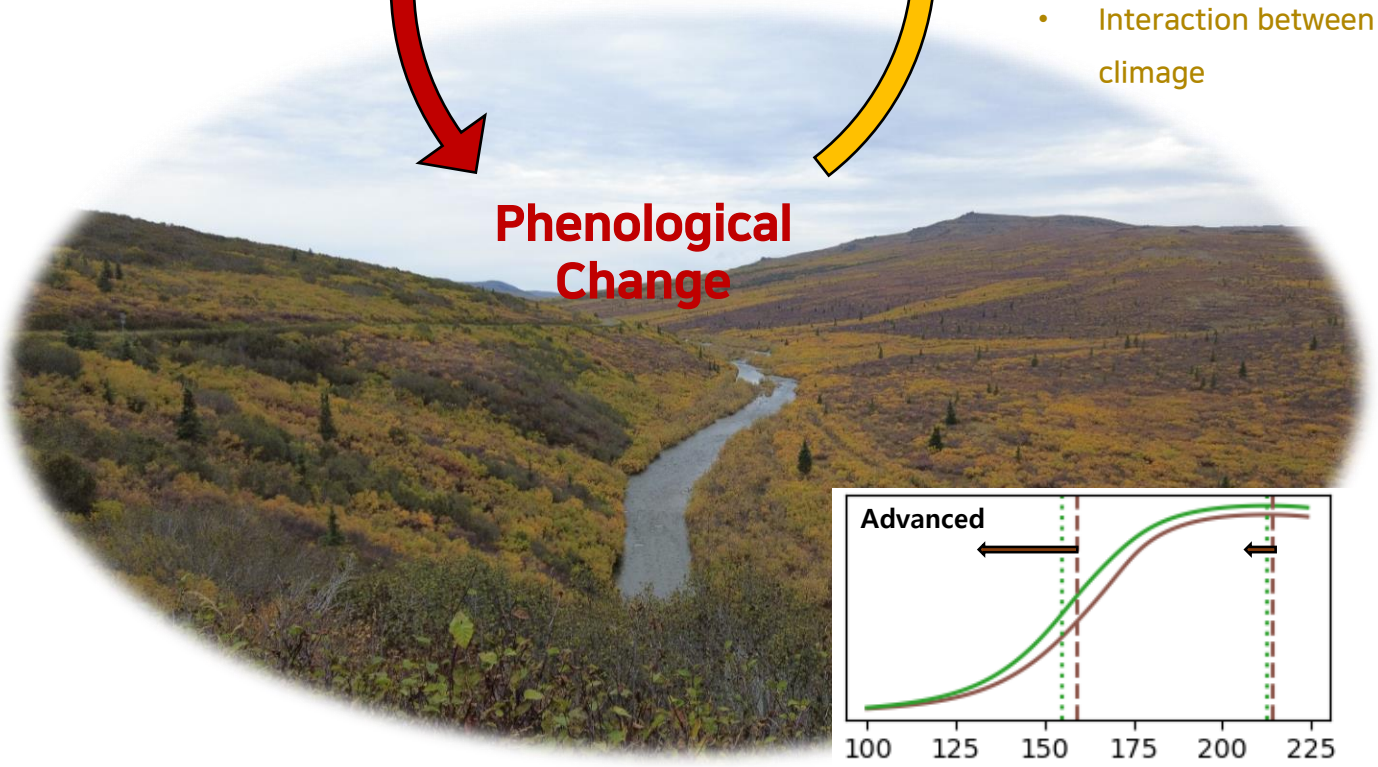
[1]Graduate School of Environmental Studies, Seoul National university

Study background

Climate change

- **Arctic amplification**
  - Extreme warming & weather on arctic region
- **Energy balance change**
  - Albedo change
  - Local climate change
- **Carbon flux change**
  - Interaction between vegetation-microorganism
  - Interaction between vegetation-climage

Phenological Change



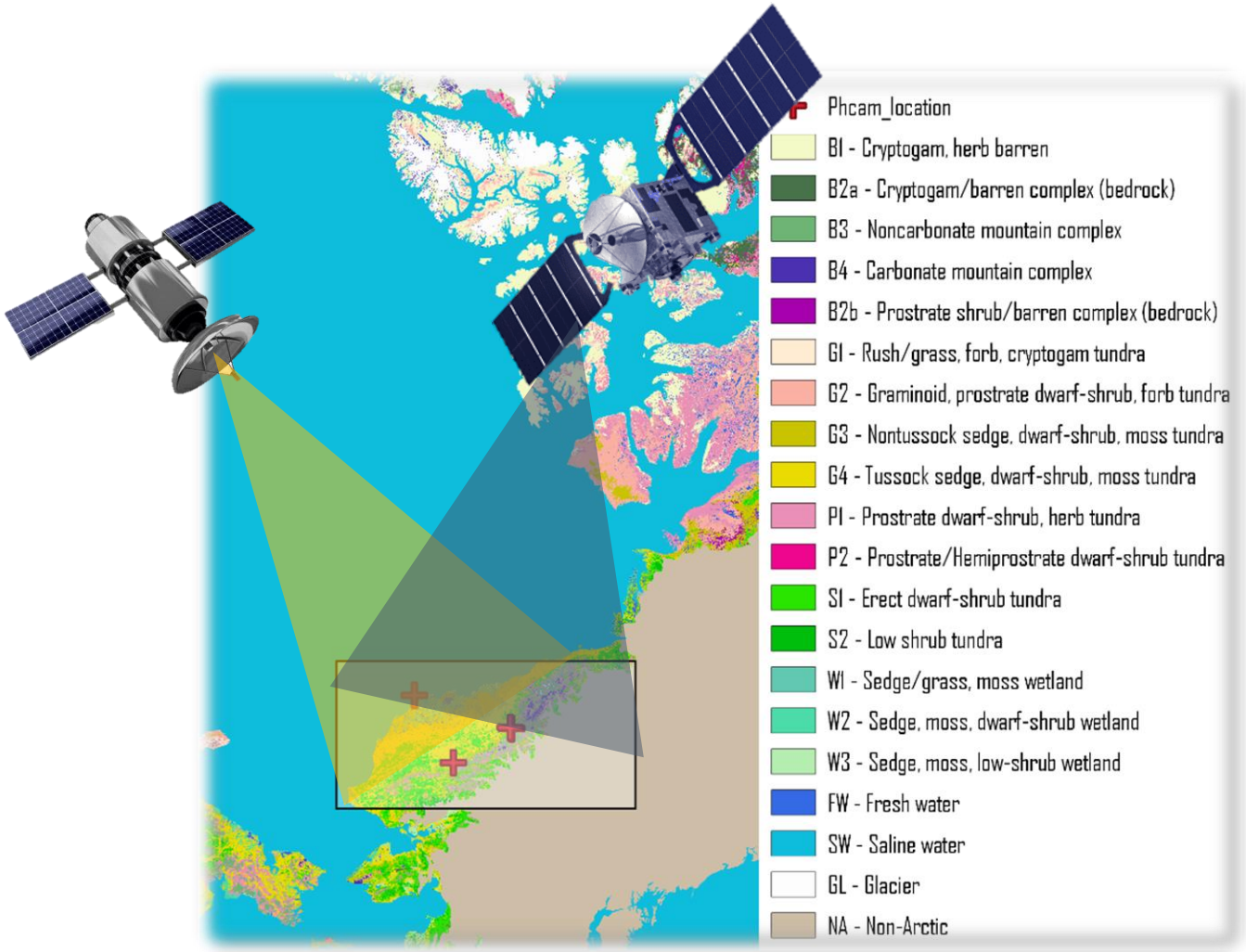
Insufficient quantitative analysis of phenology changes in the Arctic region.

It is necessary to identify the what factors change the phenology especially in spring season when climate-ecosystem interaction takes place most actively.

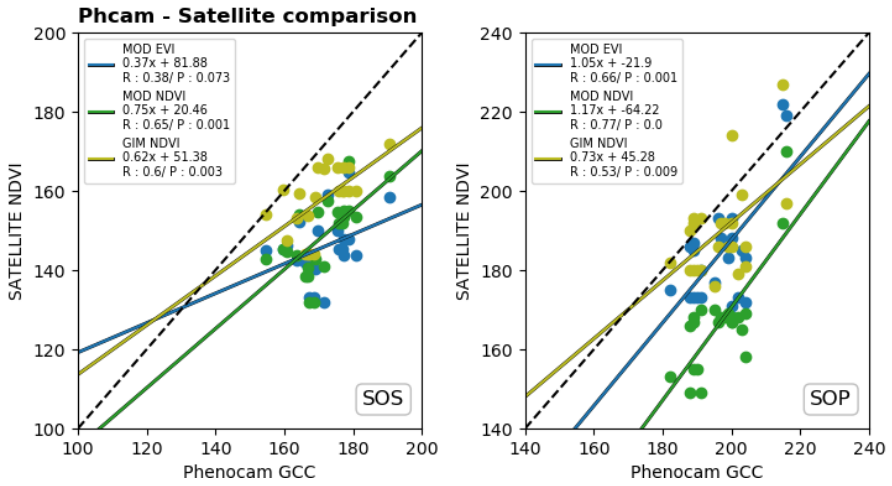
Datasets & Method

- SATELLITE : MODIS, GIMMS
- Ground dateset : Phenocam
- Climate dataset : ASRv2

  (Arctic System Reanalysis version 2)



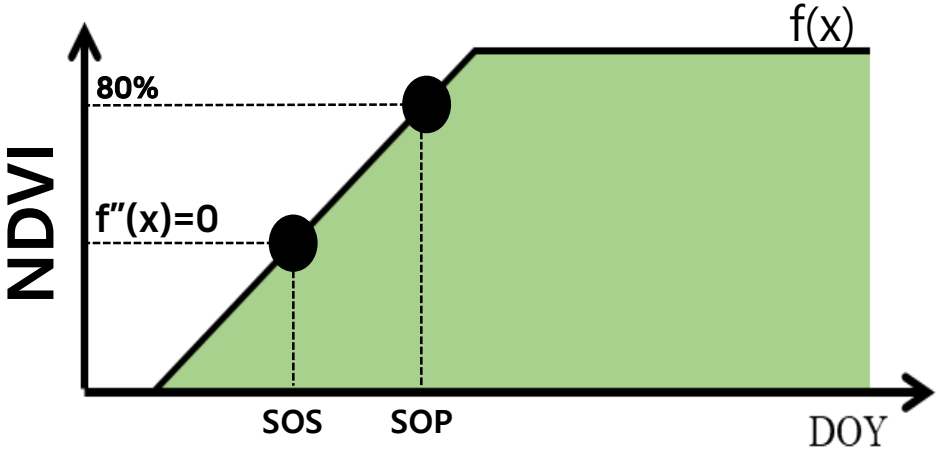
Datasets

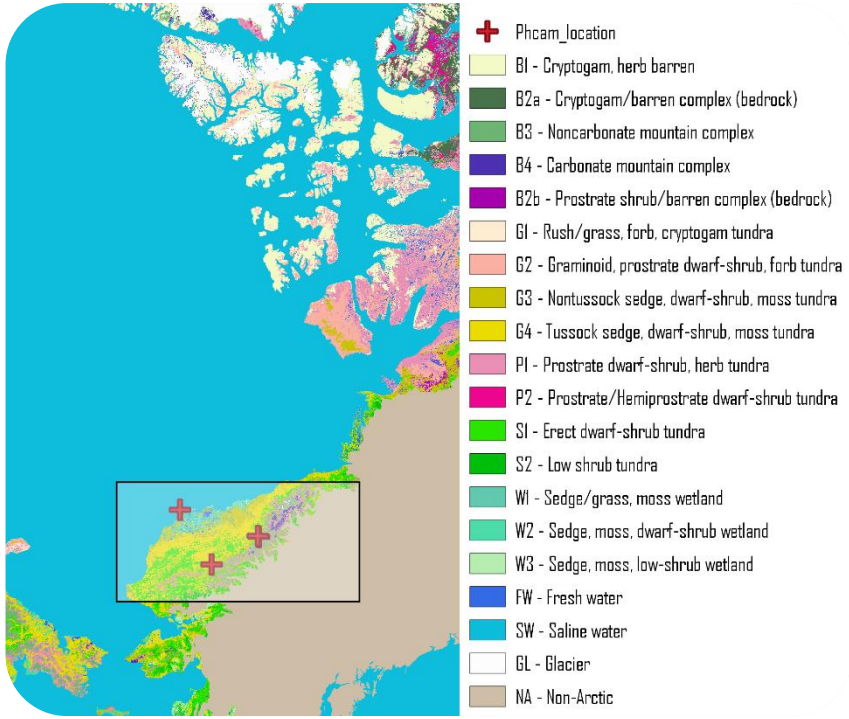


R / p value	SOS	SOP
MODIS EVI	0.38 / 0.073*	0.66 / 0.001****
MODIS NDVI	**0.65 / 0.001**** **	**0.77 / 0.000**** **
GIMMS NDVI	0.6 / 0.003***	0.53 / 0.009***

***:0.1, **0.05 ***0.01 ****0.001**

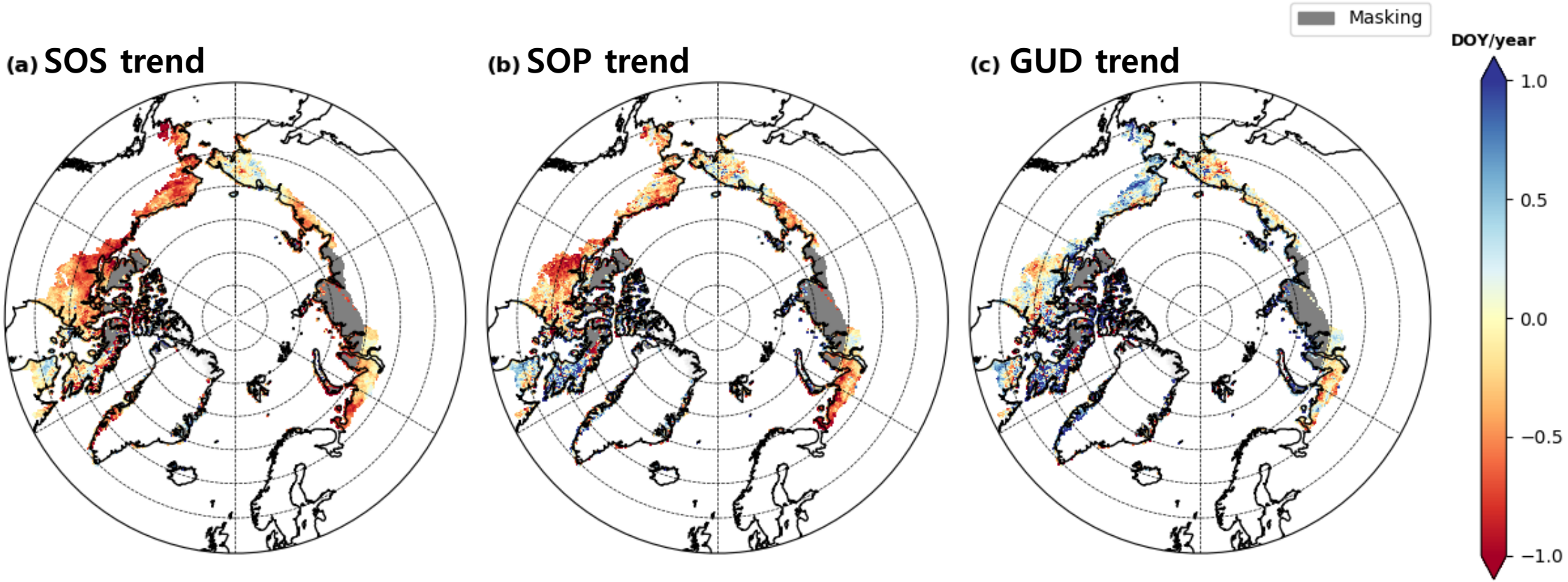
- **SOS : Start of season (식생 생장 시작 시점)**
- **SOP : Start of peak season (식생의 최대 성숙 시점)**





Result

Phenological trend between 2000 ~ 2016 using MODIS satellite



- SOS : Start of season (식생 생장 시작 시점)
- SOP : Start of peak season (식생의 최대 성숙 시점)
- GUD : SOP – SOS의 기간 (식생 생장 기간)

➔ MODIS

Result

Elements affecting phenological trend using Multi – linear regression method

- **SOS (식생 생장 시작 시점)**

  : 2m temperature (K)

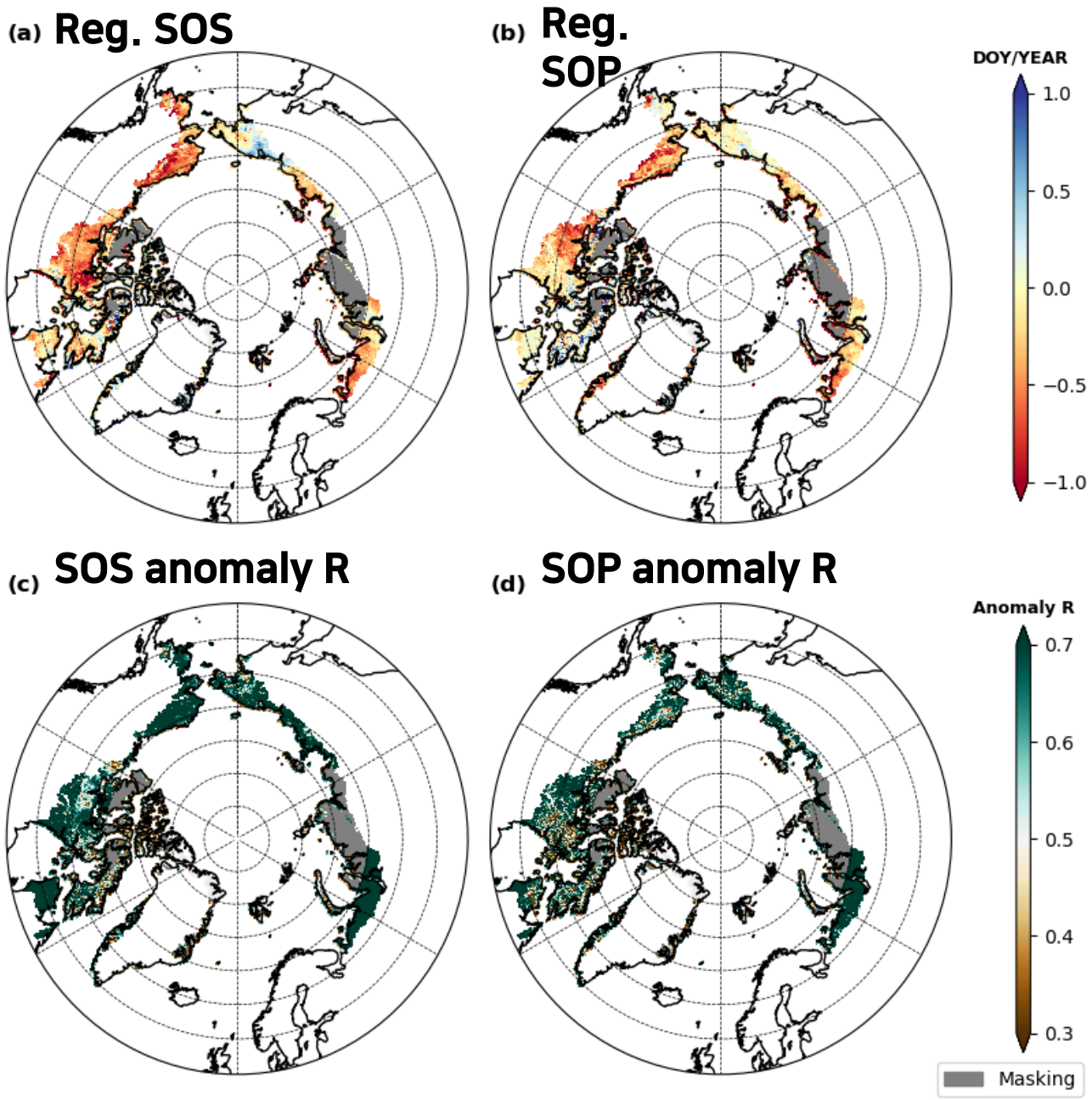
  Snow fraction (%)

  SWE (Snow Water Equivalent, kg/m^2)

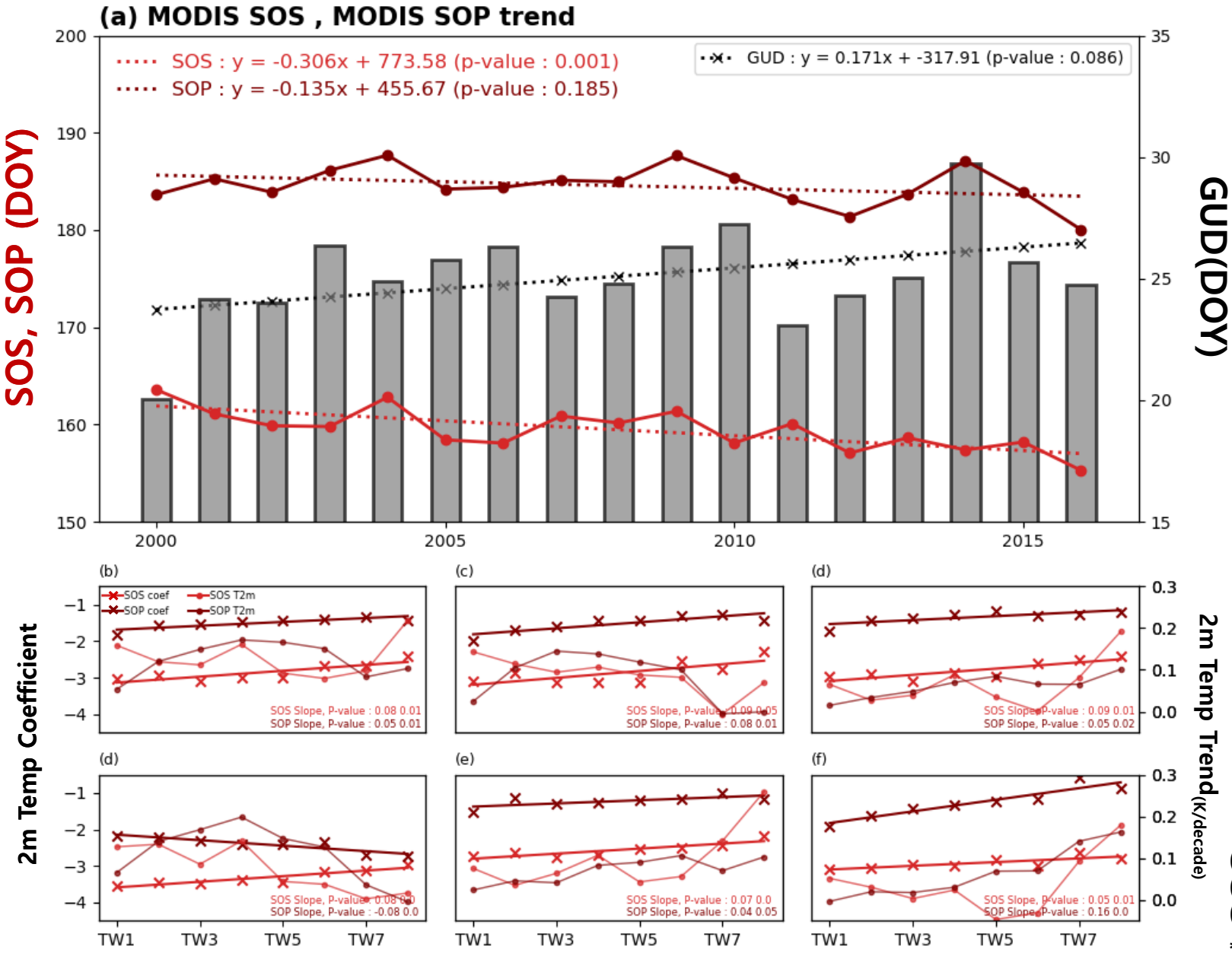
- **SOP (식생 최대 성숙 시점)**

  : SOS (Julian Date)

  2m temperature (K)



Result



➔ **This result is because SOS of tundra vegetation is more sensitive to warming than SOP.**
(2m Temp Coefficient difference of SOS and SOP)

➔ **Reasons for the difference in sensitivity**
: The vegetation damage period also increases due to the extension of the growth period due to warming.

- Liu, Q., et al. (2018). Nature Communications,
- Phoenix, G. K. and J. W. Bjerke (2016). Global change biology

(b) Low arctic region
(c) Barren
(d) Graminoid tundra
(d) Prostrate dwarf shrub
(e) Erect dwarf shrub
(f) Wetland

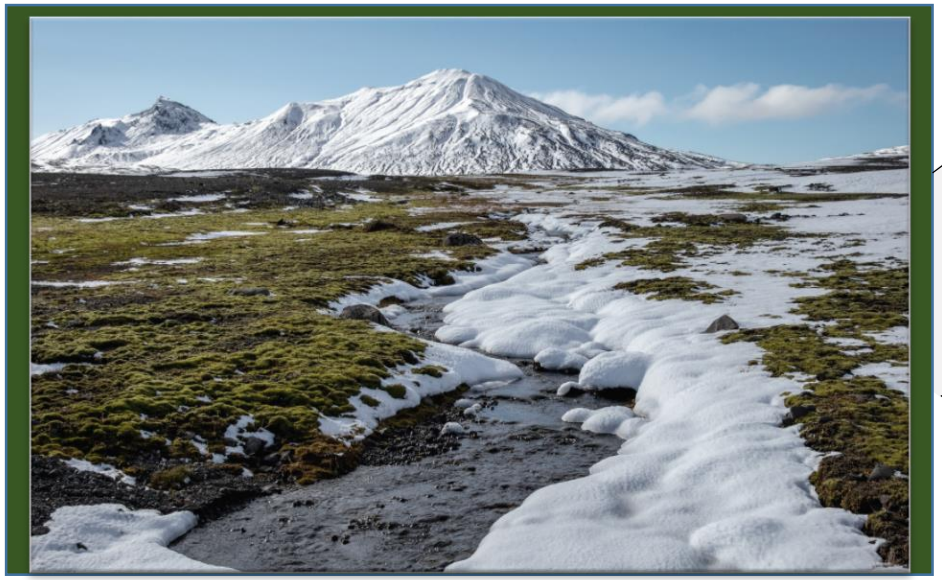
* TW : Decade Time window (e.g. TW1 : 2000~2009)

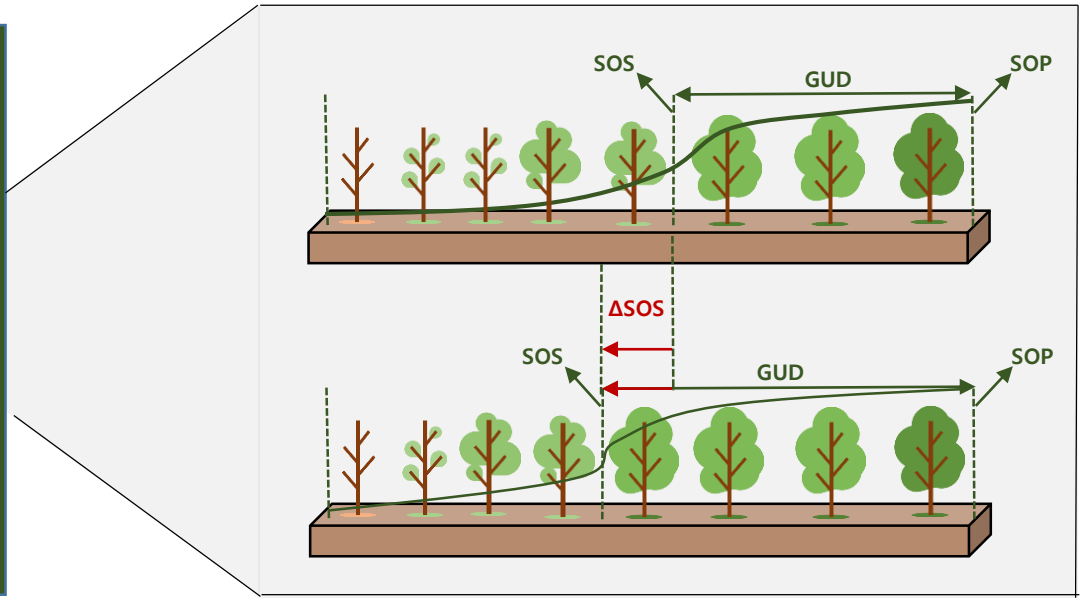
Conclusion and Discussion

I. Unlike other regions, the reason why vegetation in the Arctic region is prolonged is due to the difference in temperature sensitivity according to the degree of growth.

II. The difference in temperature sensitivity can be explained by the stress period increased by the change in growth period.

➢ As high-altitude regions in the Northern Hemisphere are of great locational importance in climate change as they store huge amounts of organic carbon, this study could contribute to **improving the accuracy of carbon flux changes** caused by climate-vegetation-soil interactions simulated by models.






Thank you for attention